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On two species of Spheæ, inhabiting Virginia and Pennsylvania, and probably extending through the United States. By B. Henry Latrobe.

Read January 21st, 1803.

Philadelphia January, 21st, 1803.

The two species of Spheæ to which this memoir is confined, are well known under the names, blue wasp, mason, and dirt-dauber. Among all the remarkable insects belonging to the order of hymenoptera of Linnæus, they appear to be most distinguished by their singular and cruel mode of providing for their young.

The two species are distinguished from each other in their manner of building, and in the form of their bodies; but agree exactly in their mode of life, in the materials of which they build their cells, and the food provided by them for their offspring.

The first, No. I. Plate I. is probably the Spheæ coerulea of Linnæus, of which the following is the description:

Coerulea, alis fuscis: habitat in America septentrionali.

This spheæ, is by far the most common of the two species: the antennæ are pointed and stand up when he is at work. His nose is furnished with a strong beak, with which he works sideways, leaving ridges on his cells which make them appear to be plaited; his thorax is thick, the abdomen petiolated. From the scutum attached to the petiole, is extended a strong hook, which is very serviceable to him in securing his prey. His sting is not very painful, and soon ceases to be troublesome. The wings which Linnæus describes as brown, play between a beautiful green, brown, and blue. The joints of the feet are yellow, the whole of the head, body, and legs are blue.

I have however seen some individuals which had yellow spots on the thorax, in front of the wings.

The other spheX, No. II. Plate I. (probably the *Pennsylvanica* of Linnæus) differs from the former in many particulars of form and colour. Linnæus's description runs thus:

Nigra, abdomine petiolato atro, alis subviolaceis. Habitat in Pennsylvania.

The specific differences are as follows:

The head is broad, the nose blunt and emarginate, his thorax is longer in proportion, the petiole of the abdomen very long, the hook is wanting, the abdomen conical and elegantly formed. The general colour is a dark blue approaching to black, but on the thorax are many yellow spots, and the legs, thighs, and feet are also spotted with yellow. His antennæ are longer than in No. I. and he carries them less upright, and often curls them. No. II. Fig. 2. is an enlarged view of his head.

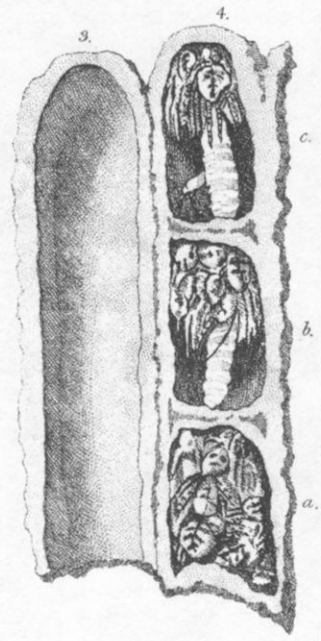
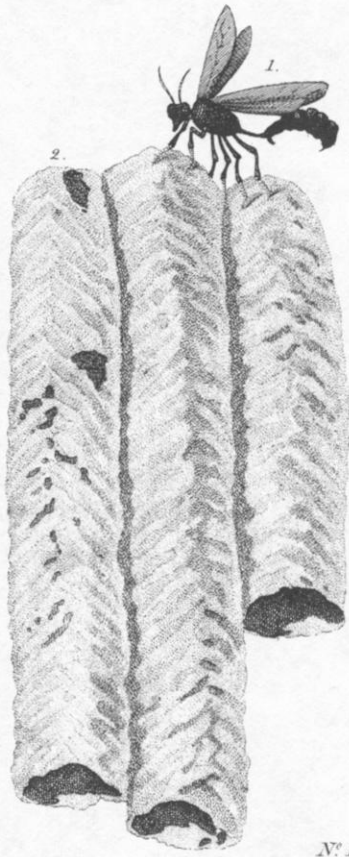
The figures both of the *coerulea* and *Pennsylvanica* are exactly the size of the live insects, and an attempt is made to imitate accurately their manner when alighting on their cells.

The cells both of the *S. coerulea* and *Pennsylvanica* are built of clay collected in moist places; but their appearance, and mode of construction is very different.

The *S. coerulea* chuses, in the open air, the south side of a rock, or of the trunk of a tree for his structure. He then seeks by the side of a stream for his materials. He scrapes the clay together with his feet, and working it into as large a round ball as he can well carry off, he begins by plaistering the stone or wood with a thin coat. He spreads the clay with his head, uttering a shrill sound during his work. He then flies off for another lump, and by degrees forms the upper ridge of his cell. He afterwards adapts a second ridge to the first, working alternately on each side, frequently going into the tube thus formed, and making it perfectly smooth in the inside. In this manner he compleats a tube of 3 or 4 inches long, before any attempt is made to carry in provisions for the young brood.

SPHEX.

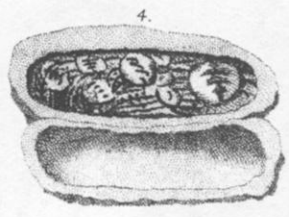
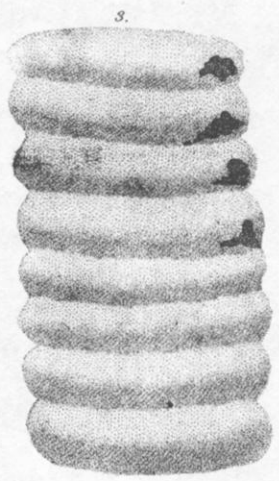
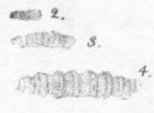
N^o I. *Caerulca.*



N^o II. *Pennsylvanica.*



N^o III



In the inside of houses, nothing furnishes both these species of sphex with a more convenient situation for their cells than the backs of picture frames; for they are fond of building in places which have a very moderate degree of light, and the back of a picture frame hanging against the wall has also the advantage of furnishing two sides of the cell. A hollow moulding of a pannel has also its strong temptations, or the internal angle of the frame of a table. In the wooden houses of Virginia they occupy all these situations in great numbers. I have seen the hollow space in the front of the books in a library occupied by a whole tribe of the sphex coerulea, which thereby saved themselves much trouble, as they had only to close the space between the edges of the binding.

The sphex *Pennsylvanica* differs exceedingly from the *coerulea* in the construction of his cells. Instead of a series of long tubes divided into separate cells, the former builds separate horizontal apartments close to each other. They are perfectly smooth internally, but roughly finished on the outside. See No. II. Fig. 3 & 4: of both these species of cells the figures give an exact representation, both as to size and form.

The food provided by both species for their offspring is however exactly the same, namely *spiders* of every genus and species, chiefly however of those who do not fortify themselves by extensive webs. There is a common yellow spider which they collect in the greatest numbers. I have however observed both the *Pennsylvanica* and *coerulea* attack large spiders, in the midst of their webs and of the dead bodies of other insects which had fallen victims to them; especially in a remarkable instance: the sphex flew nimbly at the spider and stung him. He then retired to clean himself from the cobwebs. This he did in the manner of a fly, using his hind legs to wipe his wings, and his fore legs to his head. After several attacks the spider at last attempted to escape by letting himself down to the floor, by a thread. He then ran away, but his enemy followed him, and frequently stinging him attempted to carry him off: but the spider was too large and heavy; and though the sphex endeavoured to lighten his load by biting off the spider's legs, he could not succeed while I observed him, which was for at least half an hour.

The spiders thus collected are not killed; life enough seems to be still left to preserve them from putrefaction or drying. In all the cells which I have opened, they were in a languid state capable of motion, but not of crawling along. Nothing more cruel than their condition can well be conceived. They are closely and indiscriminately packed together, waiting to be devoured piecemeal by the young worm, for whose support they are destined. See No. I 4, & No. II. 4.

Each of the cells of the sphex, *Pennsylvanica* being separately contrived to enclose a sufficient number of spiders, they are separately made. But the sphex *coerulea*, having formed a long tube, crams into it as many spiders as he judges sufficient, and encloses them, together with an egg, by a cross partition of clay. He then puts a new head to the next cell and having filled it, encloses it as the first. Thus he proceeds to the amount sometimes of 4 or 5 cells in one tube.

The egg appears to be soon hatched after deposition, though I found it impossible to ascertain the time between the closing of the cell and the escape of the young sphex.

No. I. Fig. 3 & 4, exhibit the exact state in which I found two ranges of cells at Ripponlodge in Virginia. The cells were made at the back of a picture frame, from which I cut them carefully with a table knife. The figure shows the side next to the frame. Fig. 3, is an empty tube, ready to be divided into cells. Fig. 4 a, is the last filled cell of the other range. It is full of spiders, the worm having been just hatched, and eaten nothing. b. contains a worm more advanced which has consumed half his store. c. contains another in a still greater progress to maturity, which has but little provision left. Fig. 5, exhibits the worm, which after consuming all the stock of spiders, is prepared to spin its involucre. Fig. 6, represents the chrysalis, broken. The dots exhibit its full size.

In the first range of the cells, No. I. Fig. 2; and in No. II. Fig. 3, are seen the holes by which the young sphex escapes. No. II. Fig. 4, shews the inside of two cells, carefully separated from the board on which they were built.

As I had always found the number of spiders in each cell unequal, but apparently regulated by their size, I opened a range of cells of the sphex *Pennsylvanica*, and having weighing the contents I found the result as follows. See No. III.

The lowest contained 19 spiders and a small worm, grains.
which seemed lately hatched, and had eaten nothing.

See Fig. I.—The spiders weighed $7\frac{1}{2}$

The next contained 17 spiders and one empty skin,
the worm, Fig. 2, weighed $\frac{1}{4}$ of a grain, the spiders $6\frac{1}{4}$

The third contained 19 very small spiders and a few
empty skins, weighing $5\frac{3}{4}$

The worm, Fig. 3, weighed $\frac{1}{2}$

The fourth contained only the empty skins of the spiders. The worm, Fig. 4, seemed lean and weak, he was just beginning to spin. I think he must have had a short allowance provided for him, or have been sick: he weighed $3\frac{1}{4}$

The fifth contained an involucrum in which was a large grub not yet changed to a chrysalis. The involucrum and worm being heavier than the last, weighed $3\frac{1}{2}$

The 6th and 7th cells were open at the point, the young sphex having escaped.

This examination proves that the sphex exercises a nice degree of judgment in the quantity of provision he lays up. For the cell No. 3. must have contained 22 or 23 spiders, and I have often counted only 6 or 7 in one, but they were of a large size. It also appears that the full-grown worm weighs about half as much as the food that reared him.

If it be further necessary to break the line which has formerly been drawn between reason and instinct, the economy of the whole class of hymenoptera, and especially of the sphex, will contribute towards it, I will relate a singular instance of conduct in which instinct appears to be out of the question.

In order to examine one of these insects (the *Pennsylvanica*) at work, I raised a picture frame a little from the wall. In doing this, I injured several of his cells, for the dirt sticking

to the wall was torn off, and left holes in them, through which the spiders and young worms were visible. I kept the frame about an inch from the wall so as to see plainly behind it. In a few moments the sphex returned, bringing with him a round lump of clay. He had just begun a new cell, but seeing his former work disturbed, he ran rapidly over the cells, in apparent doubt what to do. At last he put down the clay on the margin of one of the holes, and began to spread it with his nose, pushing it out before him with the action of a hog which is rooting. While he did this he made a shrill buzzing noise. Having plastered up the hole very perfectly and neatly, he flew away. In 4 minutes he returned with another lump of clay. He put it down at once by the next hole, and stopped it in the same manner. He repeated this four times, and having finished his repairs, and satisfied himself by ranging over the cells several times, he flew for another lump, with which he proceeded to compleat his new cell.

If reason be exhibited in the modification of conduct to unexpected circumstances, this surely was an instance of reasoning. The sphex saw the unexpected dilapidation of his work: it had happened in his absence: the clay he brought was for the new cell: seeing however, the injury done to his work, he thoroughly repaired the old cells, instead of building new ones.



For some interesting notices concerning the insects which are the subject of the preceding paper, see a communication by Mr. John Bartram, a member of this Society, in the Transactions of the Royal Society of London, vol. 43. No. 476, for the year 1745.